R·I·T

Title: ADT Dicing Saw

Semiconductor & Microsystems
Fabrication Laboratory **Revision**: **A** **Rev Date 4/23/2021**

Approved by:

_____ / / _____ / /
Process Engineer Equipment Engineer

1 SCOPE

The purpose of this document is to detail the use of the ADT Dicing Saw 7120. All users are expected to have read and understood this document. It is not a substitute for in-person training on the system and is not sufficient to qualify a user on the system. Failure to follow guidelines in this document may result in loss of privileges.

2 REFERENCE DOCUMENTS

- Appropriate Tool Manuals

3 INSTRUCTIONS

4 TOOLS AND MATERIALS

4.1 General Description

The ADT dicing saw (Model 7120) is a semi-automatic dicing system manufactured by advanced dicing technologies. The tool, currently, is capable of dicing 6" silicon wafers, silicon wafer pieces, glass & select materials. The current available blades are the nickel (hub) and resin (hubless). Any material other than silicon will most likely need a different blade. Talk to the tool super user or the SMFL staff for additional information.

5 SAFETY PRECAUTIONS

5.1 Hazards to the operator

5.1.1 Dicing blades are extremely sharp objects. Serious injury can be caused if not handled properly.
5.1.2 If a blade gets worn out and breaks while dicing, contact the tool super-user. Do not attempt to clean the chamber with bare hands.

5.2 Hazards to the tool

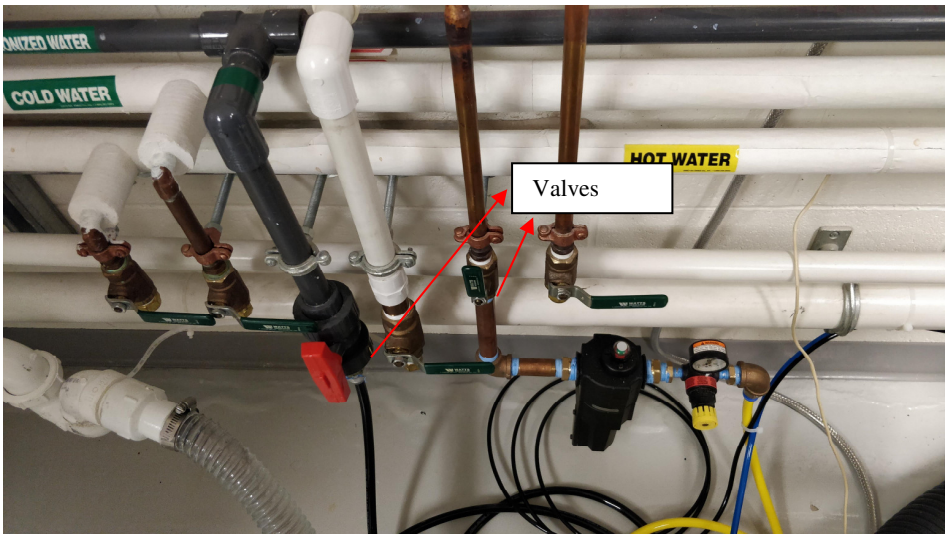
5.2.1 Do not attempt to open the front shield while the spindle is running.
5.2.2 Dicing incompatible materials can cause blade stress leading to breakage.
5.2.3 III-V materials are not allowed in the tool.
5.2.4 Do not attempt to change blades. Contact the tool super-user.

NOTE: Please contact the tool super-user to verify whether the y-offset correction (section 6.7) has been performed for the selected blade

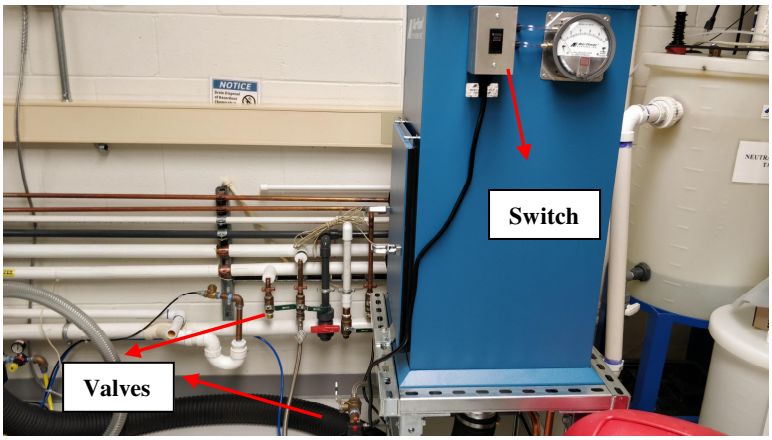
6 INSTRUCTIONS

6.1 Initial State Check

1. Turn on the air and DI water valves located on the wall behind the saw as shown in the below figure. They are marked with green tape.



2. Turn on the valves that connect the mist collector to the dicing saw outlet. The mist collector collects the mist from the dicing chamber. It needs to be turned on every time a wafer/workpiece is diced. Simply flip the switch and turn on the valves as shown in in the below figure.



3. The main power supply is usually left On. Make sure that the 'AC supply light' located at the front of the machine, below the ON/OFF buttons is on.

4. Press the **ON** button and wait for few minutes

5. Once the login screen comes up, login using the username '**Administrator**' and password '**a**'. Make sure that the **'System init**' option is checked. This step automatically initiates the system, checks the blade status, homes all the axes and re-centers the chuck.

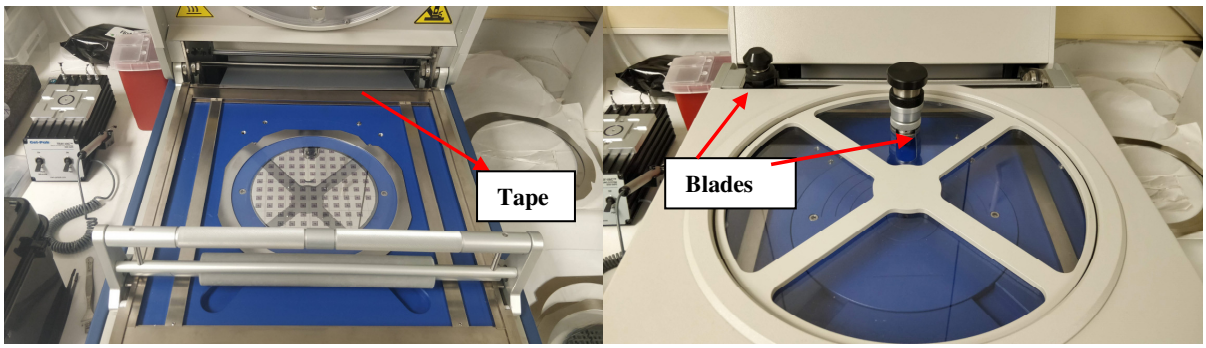
6.2 Using the tape applicator

1. Place the 6-inch wafer facing down on the tape applicator stage (use the grooves on the stage as reference markings for centering the wafer and the metal rim as shown in the picture). Turn on the vacuum.

2. Pull the tape slowly from the roll and stick it on top of the horizontal metal bar near the roller. Make sure that the tape is not stuck to the back of the wafer. This will prevent accidental air bubbles.

3. Use the roller to flatten the tape on the wafer back as shown in figure.

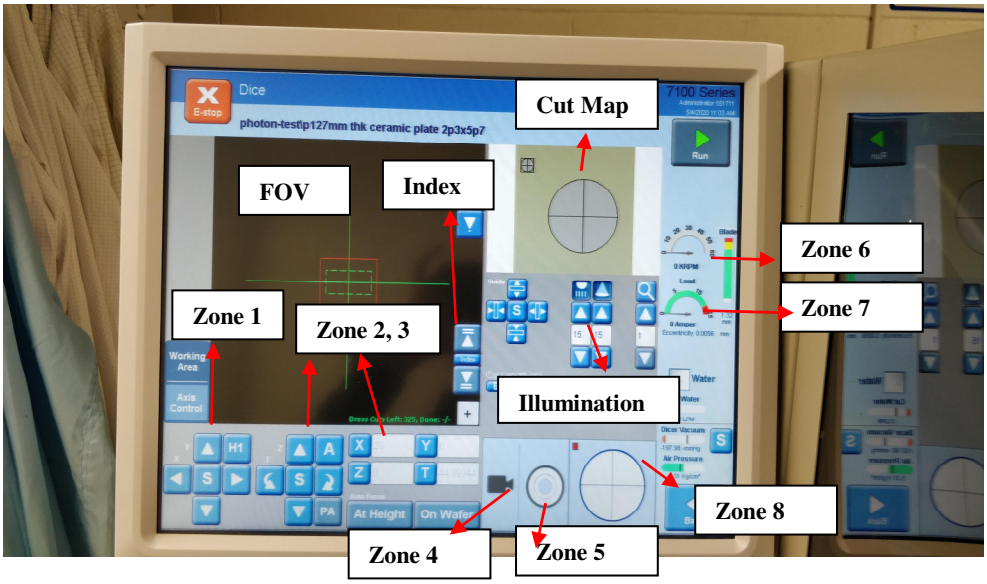
4. Close the lid and use the blades to cut out the circular portion of the tape on the metal rim. Peel out excessive tape from the stage.



6.3 Basic Operation Steps

1. From the **main menu**, click **assign job** and select the required job from the recipe list.

2. Make sure that the blade installed in the machine correctly matches with the blade number specified in the recipe. If a **new blade** needs to be installed or a **new material** (other than silicon) needs to be diced, please contact the tool super-user. The current installed blade box/cover is usually left on the top of the machine/or on the front metal ledge.



Dicing ('To Dice') screen

3. Click the **'To Dice'** button. Click on the wafer icon (**zone 8** in picture) and select **'load wafer'**. The system will now prompt to load the work piece. Place the wafer on the chuck and use the clamp to secure it in place. Press **'Ok'**

4. The machine will now take the wafer in and perform automatic adjustments.

5. Click the blade icon (**zone 5** in picture) and select **'height'** option. The machine will now perform an automatic **'non-contact height'** check and will measure the blade exposure. For user reference, the measured blade exposure value can be seen on the screen (the vertical bar to the right of zone 6 and 7).

6. Click on the video camera icon (**zone 4** in picture) in the '**to dice**' screen and select **'auto alignment'**. The chuck with the workpiece is now moved under the microscope camera. The arrows in the screen allow movement of the camera in the **left, right, up and down** on the substrate. The center button allows the user to toggle between different speeds. **'S'** is slow, **'F'** is fast, **'M'** is 1 micron and **'P'** is pixels.

7. **Aligning the wafer:**
   The message box initially prompts the user to perform '**right alignment**'. Locate a street on the wafer and fix a right alignment spot (i.e., align the crosshair to a street). Click **next**. The message box would now prompt to do the **left alignment**. Move the wafer to the left align position (on the same street, left end) and then click **next**. During this process, the theta is adjusted automatically. The alignment can be fine-tuned further by repeating these steps.

8. Clicking **finish** would prompt the user to define the **cut position**. Cut position defines the intersection point where the blade intends to cut the wafer. '**Cut position**' definition varies for GPC and APC mode cuts read **steps 9 & 10**.

9. **GPC Mode – for 6" wafers, APC Mode – for individual pieces. Verify this in your recipe.**

10. In **GPC** mode, the **cut position** is generally defined on a horizontal street. The program decides the indexing from this location. The map is displayed according to the cut position with reference to the center of the chuck. In **APC** mode, cut position defines the exact point where the blade enters or lands. It is recommended to have at least **2 mm clearance** from the edge of the wafer/piece (For example, in APC mode, if the cut position is defined anywhere inside the wafer area, the blade will plunge into the wafer and break)

11. After the cut position is defined, the cut map on screen now displays the total number of cuts that is to be made. Verify that the cuts are off the part/workpiece on both the sides and press the '**Run'** button to execute the cutting operation.

6.4 Recipe Creation

1. To create a **new recipe**, the user can either start new or re-use a recipe template from the database. It is recommended to use a template as the main parameters are already saved.

2. To re-use a template, go to recipe builder, click **template GPC basic**, then press the copy button at the right of the screen. Enter a new name for your recipe and add it to your recipe group (if there is one). The new recipe will now be stored to the recipe database. The new recipe will have all the process parameters set according to the original recipe. Contact the tool super-user for assistance with recipe creation.

6.5 Additional Features

1. From the **'To Dice'** screen, select the camera icon (**zone 4**) and click **'auto'** alignment. There is also an option to execute manual alignment which allows the user to follow the alignment procedure in a step-by-step way (for example, the user must rotate the wafer manually to the desired block orientation by pressing the rotate button in **zone 2**).

2. The message box should display 'Move the wafer to a right align position and click okay'. As instructed, move the wafer by using the arrow keys (**zone 1**) and align the wafer to a horizontal

street and then click **next**. Double clicking the Field of View (FOV) screen would also allow movement in the required direction.

3. **Zone 2** (in figure 4) allows **z (height), theta adjust and block rotation**. For example, if the user needs to toggle between 0 and 90˚ blocks while dicing, they can press the **'A'** button and click on the arrow marks.

4. Xr, Yr, Z and T in **Zone 3 (figure 4)** display the corresponding axis coordinates. These values can be useful while measuring index values/ die separation. For example, the X value at a point can be zeroed by pressing the X button until 0 appears. Then, the left/right arrows in zone 1 can be used to move to the desired X location (say, next die). Now the value in the box beside the X button would read the correct X distance. Values can also be entered manually into the boxes.

5. **Zone 6** displays the amount of **current** passing through the spindle. Ideal values are 3-5 Amps. However, dicing hard materials like sapphire might increase the current. The current range should be constantly monitored for tool safety.

6. **Zone 7** indicates the operating spindle speed. Typical speeds are **30000 RPM** for Nickel Hub blades & **24000 RPM** for resin blades.

7. **Zone 5** displays the options to change blade, y-offset, view the blade info (wear rate, exposure etc.)

8. **Zone 8** displays the options to load and unload the workpiece.

6.6 Changing blades

If the installed blade needs to the changed, contact the tool super-user. Do not attempt to change the blade.

6.7 Y-offset correction

1. Y-offset measurement/correction checks needs to be **performed after every new blade change or after a blade replacement**. Blank cuts on dummy wafers/samples can be done to check if the blade cut lands on the desired street. Make sure that the desired recipe/job with the **correct blade number** is assigned before doing the y-offset (the y-offset functionality needs the **cut map** after wafer alignment).

2. Resin blades would have a larger y-offset (they have a larger hub attached to it)

3. To execute the y-offset, go to the **'to dice'** screen and click on the blade icon (zone 5). Select y-offset from the options.

4. The message box will now prompt the user to align the wafer and define a cut position to perform the test cut. Select the desired 'dummy' position and click **'test cut'.**

5. After the cut is made, the message box will prompt the user to find the **center** of the cut. Use the field of view box (green) on the screen as reference to fix the cut location and click finish. The system will automatically assign the y-offset value.

6. **Note:** In order for the system to measure the y-offset value, the **'New to old y offset delta'** value in the recipe should be assigned a value such that when the offset cut is done by the machine, the measured value does not exceed the delta. (if the value exceeds the delta value, the machine will throw an error and will prompt the user to redo the y-offset cut).

6.8 Teach Index

1. From the **'To Dice'** screen, press the **'back'** button.

2. Click **'Teach index'**

3. The user will be prompted to do a **manual alignment** of the wafer. Follow the steps to align the wafer. After aligning, the system will display the following message 'press **'Auto'** for auto (teach mode) or **'manual'** for manual (teach street) process'. Press **'Manual'**.

4. The system will prompt the user to move to the next index position. Align the wafer to a horizontal feature (that will repeat every die) and click 'next'

5. Move to the next die and align the Field of View box to the same horizontal feature. Click **Next**. Re-align the index

6. Click **finish**. The camera would now move to the bottom of the wafer. Move to the final index position (same feature in the last die) and click finish.

7. The system will now display the taught index value. Press **'Yes'** to continue. The taught index value will now be stored in the recipe.

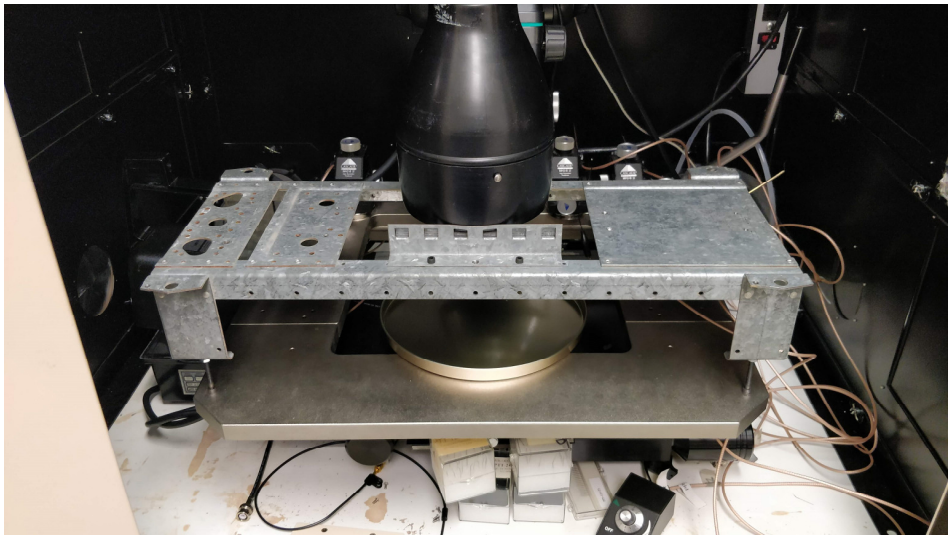
6.9 Troubleshooting

Axes errors:

If any of the axes fail to initialize, or any anomaly with respect to axis operation is detected, they can be manually re-initialized by going to **Maintenance** and clicking **axis setup**. The axis setup screen displays options to initialize the x, y, z, t axis individually by pressing the **'init'** button on each. The **'start self-test'** option would move the chuck in the specified axis direction at the maximum velocity indicated in the table. This step can ensure free movement of the chuck.

6.10 UV Tape Release

The UV tape release setup is located at the farther end of the CMP room towards the left side. Place the diced wafer (with tape and metal rim) face down on the holder and turn on the lamp (switch is located on the side of the cabinet). Avoid looking into the UV light directly and use eye protection goggles located on the top of the cabinet. Ideal time for curing is ~30 minutes. After curing, the diced pieces can be easily lifted off from the tape using plastic tweezers.



6.11 Shutdown procedure

1. After dicing, turn off the mist collector.
2. Clean the wafer loading area with the air gun located on the side and use wipes to clear water droplets.
3. Make sure that the spindle is not running.
4. From the main menu screen, turn off the machine by pressing the off button directly.
5. Wait for the machine to shut down and turn off the valves at the back of the machine.

REVISION RECORD

Summary of Changes	Originator	Rev/Date
Rev A	Venkatesh Deenadayalan	4/23/2021